CLAIMS

What is claimed is:

1. An apparatus for drilling a borehole and determining a parameter of interest of a formation surrounding the borehole during drilling operations, said apparatus comprising:

   a longitudinal member for rotating a drill bit and adapted to be conveyed in the borehole;

   a sensor assembly slidably coupled to said longitudinal member, said sensor assembly including at least one sensor for obtaining measurements relating to the parameter of interest; and

   wherein, when the sensor assembly is held in a non-rotating position, the longitudinal member is free to rotate.

2. The apparatus of claim 1 further comprising:

   a flow path between the sensor assembly and the longitudinal member for allowing the flow of a drilling fluid.

3. The apparatus of claim 1 wherein the sensor assembly further comprises:

   at least one clamping device for engaging the borehole to clamp the sensor assembly to the borehole.

4. The apparatus of claim 3 wherein the at least one sensor is located on said at least

one clamping device.

5. The apparatus of claim 1 wherein the sensor assembly further comprises at least one transmitter for sending signals into the formation for obtaining information about the parameter of interest..

6. The apparatus of claim 3 further comprising:

at least one transmitter located on said at least one clamping device.

7. The apparatus of claim 1 wherein the sensor assembly is slidably coupled to the longitudinal member using at least one guide sleeve slidably coupled to said longitudinal member.

8. The apparatus of claim 1 wherein the longitudinal member is a segment of drill pipe.

9. The apparatus of claim 1 wherein the longitudinal member is a shaft on a downhole directional drilling assembly.

10. The apparatus of claim 1 further comprising:

at least one transmitter for transmitting a pulsed radio frequency field.

11. The apparatus of claim 10 wherein the at least one sensor comprises a sensor for obtaining nuclear magnetic resonance measurements.

12. The apparatus of claim 1 wherein the at least one sensor comprises a sensor for providing azimuthal measurements and determining a tool face orientation of the sensor assembly.

13. The apparatus of claim 12 further comprising:

a rotational positioning control device for positioning the sensor assembly to a desired tool face orientation.

14. The apparatus of claim 1 further comprising:

a support device selected from (i) a spring, and (ii) a hydraulic cylinder, said support device fixedly attached to the longitudinal member for holding the sensor assembly against gravitational pull and for axial movement of the sensor assembly.

15. The apparatus of claim 14 wherein the support device is a spring, the apparatus further comprising:

a conduit through said spring device for providing transfer of data and power to and from the sensor assembly.

16. The apparatus of claim 1 further comprising:

a device for providing a non-continuous movement of the sensor assembly relative to propagation of the longitudinal member.

17. The apparatus of claim 16 wherein the device is selected from (i) a belt drive device, (ii) a chain drive, and (iii) an electrical stepper motor

18. The apparatus of claim 1 further comprising:

at least one thruster connected to the sensor assembly for providing axial decoupling of the sensor assembly from the longitudinal member and for dampening vibrations to the sensor assembly.

19. The apparatus of claim 18 wherein, when said at least one thruster is connected below the sensor assembly, the at least one thruster provides for weight-on-bit during drilling operations.

20. The apparatus of claim 18 wherein, when said at least one thruster is connected above the sensor assembly, the at least one thruster provides for continuous feeding of a drillstring during drilling operations.

21 The apparatus of claim 18 further comprising:

at least one knuckle joint connected to said at least one thruster for

providing further axial decoupling of the sensor assembly from the longitudinal member.

22. The apparatus of claim 1 wherein the sensor assembly is slidably coupled to the longitudinal member using at least two stabilizers slidably coupled to said longitudinal member and connected to said sensor assembly through at least one shaft.

23. The apparatus of claim 1 wherein the apparatus is adapted to be conveyed on a drillstring.

24. The apparatus of claim 1 wherein the apparatus is adapted to be conveyed on a coil tubing.

25. The apparatus of claim 3 wherein the at least one clamping device is selected from the group consisting of: (i) hydraulically operated clamping device, (ii) spring operated clamping device, and (iii) electrically operated clamping device.

26. The apparatus of claim 1 wherein the parameter of interest is selected from the group consisting of: (i) resistivity of the formation, (ii) density of the formation, (iii) compressional wave velocity of the formation, (iv) fast shear wave velocity of the formation, (v) slow shear wav velocity of the formation(vi) dip of the

formation, (vii) radioactivity of the formation, (viii) nuclear magnetic resonance characteristic of the formation, (ix) pressure of a fluid in the formation, (x) mobility of a fluid in the formation, and (xi) permeability of the formation to flow of a fluid therein.

27. The apparatus of claim 1 wherein the sensor assembly is adapted to recover a sample of a fluid from the formation.

28. A method for determining a parameter of interest of a formation surrounding a borehole while drilling the borehole, the method comprising

conveying a longitudinal member operatively coupled to a drill bit in the borehole;

slidably coupling a sensor assembly to said longitudinal member wherein the sensor assembly includes at least one sensor;

holding the sensor assembly in a non-rotating position for at least a period of drilling distance while rotating the longitudinal member to drill the borehole; and

obtaining measurements relating to the parameter of interest using the at least one sensor.

29. The method of claim 28 further comprising:

flowing a return drilling fluid through a flow path between the sensor

assembly and the longitudinal member.

30. The method of claim 28 wherein the step of holding the sensor assembly in a non-rotating position further comprises:

activating at least one clamping device in the sensor assembly to engage the borehole in a first location in the borehole; and

clamping the sensor assembly in said non-rotating position.

31. The method of claim 30 further comprising:

deactivating the at least one clamping device in the sensor assembly to disengage the borehole;

moving the sensor assembly to a second location in the borehole;

activating the at least one clamping device in the sensor assembly to engage the borehole in the second location in the borehole; and

clamping the sensor assembly in said non-rotating position.

32. The method of claim 30 further comprising:

locating the at least one sensor on the at least one clamping device.

33. The method of claim 28 wherein the sensor assembly further includes at least one transmitter.

34. The method of claim 30 wherein the sensor assembly further includes at least one transmitter and further comprising:

locating the at least one transmitter on the at least one clamping device.

35. The method of claim 28 wherein the step of slidably coupling the sensor assembly to said longitudinal member further comprises:

slidably coupling at least one guide sleeve to said longitudinal member wherein the sensor assembly is slidably coupled to the longitudinal member using said at least one guide sleeve.

36. The method of claim 28 wherein the longitudinal member is a segment of drill pipe.

37. The method of claim 28 wherein the longitudinal member is a shaft on a downhole directional drilling assembly.

38. The method of claim 28 wherein the sensor assembly further includes at least one transmitter and further comprising:

transmitting a radio frequency field into the formation.

39. The method of claim 38 further comprising:

obtaining nuclear magnetic resonance measurements using the at least one

sensor.

40. The method of claim 28 further comprising:

obtaining azimuthal measurements using the at least one sensor; and

determining a tool face orientation of the sensor assembly.

41. The method of claim 40 further comprising:

positioning the sensor assembly to a desired tool face orientation using a rotational positioning control device.

42. The method of claim 28 further comprising:

fixedly attaching a support device to the longitudinal member;

holding the sensor assembly against gravitational pull using said spring device; and

providing for axial movement of the sensor assembly using said support device.

43. The method of claim 42 wherein the support device is a spring, the method further comprising:

locating a conduit in said spring device; and

transferring data and power to and from the sensor assembly through said conduit.

44. The method of claim 28 comprising:

fixedly attaching a hydraulic cylinder device to the longitudinal member;

holding the sensor assembly against gravitational pull using said hydraulic cylinder device; and

providing for axial movement of the sensor assembly using said hydraulic cylinder device.

45. The method of claim 28 wherein the step of holding the sensor assembly in a non-rotating position further comprises:

coupling a stepping device selected from the group consisting of (i) a belt drive, (ii) a chain drive, and (iii) a stepping motor, to the sensor assembly the stepping device providing a non-continuous movement of the sensor assembly relative to propagation of the longitudinal member.

46. The method of claim 28 further comprising:

connecting at least one thruster to the sensor assembly;

axially decoupling the sensor assembly from the longitudinal member using said at least one thruster; and

dampening vibrations to the sensor assembly using said at least one thruster.

47. The method of claim 46 wherein the step of connecting at least one thruster to the sensor assembly further comprises:

connecting said at least one thruster below the sensor assembly for providing weight-on-bit while drilling the borehole.

48. The method of claim 46 wherein the step of connecting at least one thruster to the sensor assembly further comprises:

connecting said at least one thruster above the sensor assembly for providing continuous feeding of a drillstring above the sensor assembly while drilling the borehole.

49. The method of claim 46 further comprising:

connecting at least one knuckle joint to said at least one thruster for providing further axial decoupling of the sensor assembly from the longitudinal member.

50. The method of claim 30 further comprising:

connecting at least one lower thruster below the sensor assembly;

connecting at least one upper thruster above the sensor assembly;

axially decoupling the sensor assembly from the longitudinal member using said at least one lower thruster and said at least one upper thruster; and

dampening vibrations to the sensor assembly using said at least one lower thruster and said at least one upper thruster.

51. The method of claim 50 further comprising:

extending the at least one lower thruster and contracting the at least one upper thruster when the sensor assembly is clamped in the non-rotating position; and

deactivating the at least one clamping device in the sensor assembly to disengage the borehole; and

contracting the at least one lower thruster and expanding the at least one upper thruster when the sensor assembly is disengage from the borehole.

52. The method of claim 28 wherein the step of slidably coupling the sensor assembly to the longitudinal member further comprises:

slidably coupling at least two stabilizers to said longitudinal member; and

connecting at least one shaft from the at least two stabilizers through the sensor assembly wherein the sensor assembly is slidably coupled to the longitudinal member using said at least two stabilizers.

53. The method of claim 30 wherein the step of activating the at least one clamping device further comprises:

locating a processor in the sensor assembly;

using said processor for activating the clamping device; and

using said processor receiving data from the at least one sensor.

54. The method of claim 28 further comprising:

conveying the longitudinal member on a drillstring.

55. The method of claim 28 further comprising:

conveying the longitudinal member on a coil tubing.

56. The method of claim 30 wherein the at least one clamping device is selected from the group consisting of: (i) hydraulically operated clamping device, (ii) spring operated clamping device, and (iii) electrically operated clamping device.

57. The method of claim 28 wherein the parameter of interest is selected from the group consisting of: (i) resistivity of the formation, (ii) density of the formation, (iii) compressional wave velocity of the formation, (iv) fast shear wave velocity of the formation, (v) slow shear wave velocity of the formation(vi) dip of the formation, (vii) radioactivity of the formation, (viii) nuclear magnetic resonance characteristic of the formation, (ix) pressure of a fluid in the formation, (x) mobility of a fluid in the formation, and (xi) permeability of the formation to flow of a fluid therein.

58. The method of claim 28 further comprising using a formation fluid sampling device on the sensor assembly to obtain a sample of a fluid from the formation.